Hawaiian *materia medica* for asthma*

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A literature search and traditional narration determined that at least 58 herbs with scientific names were commonly used by Hawaiians for asthma. Of particular note were Piper methysticum, solanum americanum, *and* Aleurites moluccana *with oral tradition singling out* Sophora chrysophylla. *These four therapeutic agents, especially* Sophora, *have scientific merit and warrant further investigation because of the recent increase in asthma mortality, their potential for improved patient compliance, minimal of side effects, and the low cost.*

Introduction

In traditional Hawaii, illness or *ma'i* was caused by a loss in *mana* (energy, power) and of *pono* (balance). Return to normal levels of *mana* and of *pono* was sought through holistic methods, which included religious ceremonies, psychospiritual seances, massage, and *materia medica*[1a, 2a]. A comprehensive review is available[3].

Plant products were prescribed by the traditional Hawaiian physician, the *Kahuna la'au lapa'au*, and by knowledgeable commoners. *Kahuna* knowledge, skills and attitudes were passed from generation to generation through oral tradition. There is evidence that the *kahuna* used scientific methodology[4] which extended to performing autopsies to determine the cause of death.

Following western contact in 1778, the activities of the *kahuna* were suppressed, as were all aspects of Hawaiian culture, and relatively little remains of the knowledge and experience of the pre-Captain-Cook days. Some of this oral tradition does persist with certain practitioners.

The oldest published account of the Hawaiian *materia medica* was printed in the Hawaiian newspaper *Ka Hae Hawaii* in the mid-1800s; it was recently translated to English by Chun[1a]. Practitioners were meticulous regarding preparation, dosages and observation for side effects[5].

Turning now to the specific problem of asthma, Hawaiians have always been reported as having the highest asthma mortality per 100,000 ($p<0.01$) compared to other ethnic groups in Hawaii[6]. In fact, Krauss notes "The Hawaiians seem to have suffered frequently from respiratory ailments since there are many cures recorded for these"[7]. Neither was royalty spared; in 1863, Alexander Liholiho, known as King Kamehameha IV, died of asthma[8].

Given the severe and increasing asthma mortality of the 1980s and 1990s in Hawaii, we have reviewed the Hawaiian *materia medica*, especially the written to determine if selected asthma medications should be further examined by scientific trials.

Materials and Methods

Two sources were consulted: the literature and well-respected, practicing Hawaiian healers. The literature search revealed herbs used by Hawaiians for asthma or *hano*. The Hawaiian and scientific names as well as selected illustrations, preparation techniques, and chemical constituents were specified.

Matching scientific names with Hawaiian names was mainly based on Wagner et al[9a]; Nagata[10]; Gutmanis[11]; Handy et al[5]; Bushnell et al[12]; Abbott and Shimazu[13]; Degener et al[14]; and Porter[15]. Abbott[16] and Mehrhoff[17] verified all scientific names. Classification of plants whether native, indigenous or introduced into Polynesia was provided by Abbott and Shimazu[13], by Wagner et al[9a] and others.

One Hawaiian healer[18] was questioned about the herbs used for asthma and said her expertise was based on oral tradition dating back to 800 AD.

Results

A. *Herbs in the literature*

Fifty-eight herbs were well documented as having been used for the treatment of asthma in Hawaii (Tables 1a-1c). Some medications were used in combination such as *Ipomoea cairica* and *Argyreia tilia* which called for a laxative to end the treatment. Certain plants have not been included because they do not have a scientific taxonomy equivalent eg, *kalaipahoa*[19] and *lauhulu*[5].

B. *Herbs in the oral tradition*

Much of the ancient *materia medica* for asthma is unpublished ie, it is anecdotal by word of mouth. *Sophora chrysophylla* is one such medication.

C. *Preparation of medication*

Although not all the references provided herbal preparation procedures, a typical example is from *Kaaiakamanu* and *Akina*[19].

"This tree, [*Cheirodendron trigynum*], has bark which, if mixed with other remedies, is effective for a bad case of asthma. This remedy may be prepared as follows: Take the bark of 4 *olapa* roots, the bark of 4 *Waltheria americana* [*W.*

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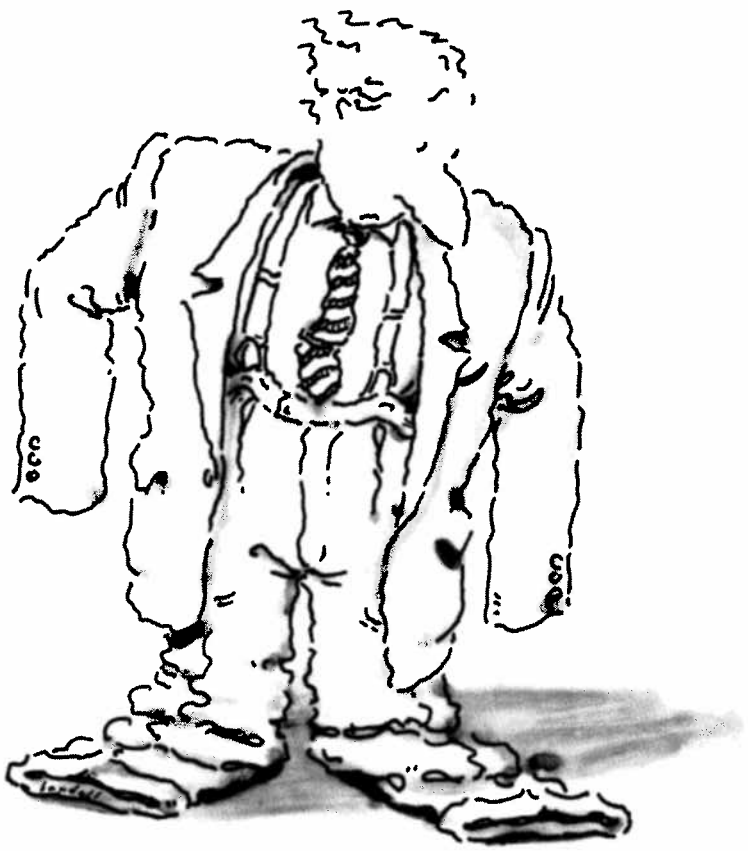

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indica] roots, the bark of four popolo roots, a piece of the koa bark, 4 *Morinda citrifolia* fruits, a hatful of the leaves, flowers and fruits of the popolo, and two segments of white sugarcane. Have these materials thoroughly pounded together and the juice pressed out and strained. The patient then takes a mouthful of the liquid each morning and evening. *Campylotheca – bidens* tea should be used regularly with *Psilotum triquetrum* (now known as *P. nudum*) as drinking water."

Figure 1: *Piper methysticum*, 'awa

D. *Posture during treatment*

According to Handy et al[5], respiratory treatments were taken with the patient lying prone in the lordotic position.

E. *Scientifically documented Materia Medica*

Many of the 58 herbs are not documented scientifically but some are: four of these are now considered in detail.

***Piper methysticum* – 'awa, kava**

• Botany: (Fig 1[16]) Piper is a pantropical genus comprised of more than 2,000 species. It was introduced to Hawaii by Polynesians, grows as a shrub 1.5 to 3 meters tall, and is found at an altitude of 50 to 500 meters on all major Hawaiian islands except Kaho'olawe, Ni'ihau and Lana'i[9b].

• Chemistry: It contains 7 major and 8 minor lactones or kavalactones. Among the former are kawain, dihydrokawain, methysticin[20], dihydromethysticin, yangonin[21], and tetrahydroyangonin[22]; also found are benzoic acid and cinnamic acid[23a]. A more detailed review of research on *kava* is provided by the South Pacific Commission[24a]. The chemical structures of kawain, methysticin, and yangonin[24b] are known.

• Pharmacology: Anti-inflammatory properties are exhibited by dihydromethysticin, methysticin, dihydrokawain, kawain, and yangonin. Dihydromethysticin and dihydrokawain are muscle relaxants[25a]; benzoic acid is an expectorant[25b].

• Toxicity: Piper depresses the central nervous system[26] and may cause inflammation of eyes and skin[25c].

• Therapy: Asthma[19,27].

• History: *Awa* also was used as a mildly intoxicating beverage and for religious ceremonies[2b].

***Solanum americanum* – popolo, glossy nightshade**

• Botany: (Fig 2.)[16] Indigenous popolo is a plant that reaches

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TABLE 1a - HAWAIIAN MATERIA MEDICA USED FOR ASTHMA

BOTANICAL	HAWAIIAN, COMMON	SOURCE	FORMAT
Acacia koa gray[19,34]	KOA	1, E	B
Aleurites moluccana[19,11,5,1b]	KUKUI, candlenut	P	B, F, nut
Argemone glauca[19,11]	PUAKALA, prickly poppy	E	F, B, R, NS
Argyreia tilia[19]	PILIKAI	X	NS
Artemisia australis[19,11]	'AHINAHINA, Oahu wormwood	E	L, T, R/tea
Asplenium nidus[19]	'EKAHAKAHA	I	S, R, NS
Bidens spp[19]	KO'OKO'OLAU	E	St, Bd, L/tea, F
Capsicum annuum[19]	NIOI, chili	X	NS
Carica papaya[19]	HE'I	N	Fr
Chamaesyce multiformis[19]	'AKOKO	E	L, Bd
Cheirodendron trigynum[19,34]	'OLAPA	E	B, R
Cinnamomum camphor[19]	PILALI	N	NS
Clermontia arborescens[19,10]	'OHA-WAI-NUI	E	Sh,Fr
Cocos nucifera[19]	NUI, coconut	P	Fr, milk
Colocasia esculenta[19,5]	KALO, taro	P	L,NS
Cordyline fruticosa[19]	KI or TI	P	F, L, R, S
Curcuma longa[19]	'OLENA, tumeric	P	Bb, tuber
Cyperus laevigatus[19]	MAKALOA	I	Fibres, tea
Datura stramonium[10]	KIKANIA, jimsonweed	X	L
Desmodium uncinatum[19,34]	PUAPILIPILI	X	L, smoke
Digitaria setigera[11]	MAU'U KUKAE PUA'A, itchy crabgrass	I	grass

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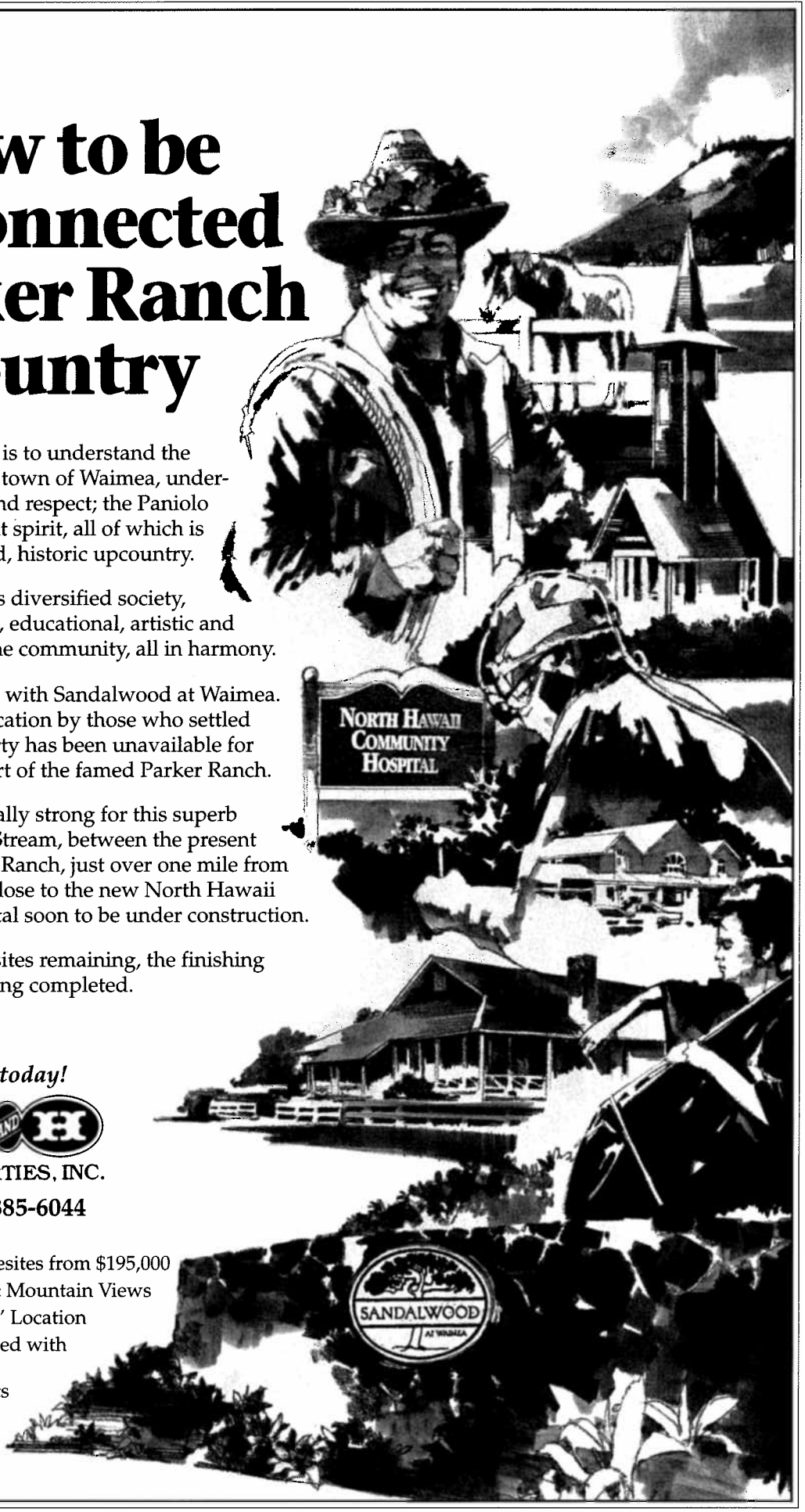

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1.2 meters in height and grows from sea level to an altitude of 2,380 meters. It is found on all Hawaiian Islands and neighboring atolls[9c].

Figure 2: *Solanum americanum*, popolo

• Chemistry: Although its active chemical components are unknown, studies of closely related plants such as *S. nigrum* may provide clues. The immature fruit of *S. nigrum* contains steroidal glycosides and alkaloids[28]. The alkaloids of the Genus Solanum include solanidine, solanine[29], and solasonine, which can be converted into solasodine, and thus be used to manufacture steroidal drugs[30,31,32]. The chemical structure for solanine and solasodine are known[33a].

• Pharmacology: Solanine has antihistaminic properties, perhaps from its steroidal properties, and solasodine is an anti-inflammatory agent[25d].

• Toxicity: No side effects are documented for *S. americanum,* but toxicity of *S. nigrum* includes coma, paralysis, diarrhea, and rarely respiratory death[25e].

• Therapy: Asthma[19,34].

• History: Popolo was used for food[2c].

***Aleurites moluccana* – kukui, candlenut**

• Botany: (Fig 3)[16] Found in tropical areas worldwide, *A. Moluccana* is a tree 10 to 20 meters tall. It grows from sea level to 700 meters. Introduced by Polynesians, it is found on all islands except Kaho'olawe[9d].

• Chemistry: Alkaloids have been found in the immature and mature fruit[35]. The bark has 5% tannin and the oil contains glycerides of oleic acid, linoleic acid, and linolenic acid. Other constituents include saponin and phytotoxin[25f].

Figure 3: *Aleurites moluccana*, kukui

• Pharmacology: Its anti-asthma action may reside in the alkaloids and glycerides.

• Toxicity: Kukui is considered to have intermediate toxicity compared to *A. montana* and *A. trisperma*[36], particularly on the gut.

• Therapy: Asthma[1,5,11,19].

• History: Hawaiians used the oil for torches and the wood for canoes[2d].

***Sophora chrysophylla* – mamane, mamani**

• Botany: (Fig. 4)[16] The genus Sophora is found in temperate and tropical areas from India to the southwest United States and

TABLE 1b - HAWAIIAN MATERIA MEDICA USED FOR ASTHMA

BOTANICAL	HAWAIIAN, COMMON	SOURCE	FORMAT
Dodonaea viscosa[34]	'A'ALI'I	E, I	L
Eleocharis sp[19]	KOHEKOHE, spikerush	I	reeds
Eucalyptus spp[11]	PALEPIWA	X	B, vapor
Heliotropium anomalum[19]	HINAHINAKUKAHAKAI or HINAHINA	I	R, L, NS
Heteropogon contortus[19]	PILI	I	NS
Ipomoea batatas[19]	'UALA, HUAMOA, sweet potato	P	NS, Bb
Ipomoea cairica[19]	KOALI 'AI	1, X	NS, R
Ipomoea sp.[19]	KOALI	I	Bb
Ipomoea pes-carpae[19]	POHUEHUE, beach morning glory	I	NS
Lythrum maritimum[19]	PUKAMOLE	I	R
Metrosideros macropus[19,5]	LEHUA	E	L, B
Monostroma latissimum[19]	LIMUPAHAPAHAKAI, seaweed	I	NS
Morinda citrifolia[19,34]	NONI, Indian mulberry	P	Fr, B
Musa x paradisiaca[19,5]	MAI'A, banana	P	R, F, Fr, L
Myoporum sandwicense[19]	NAIO	E, I	L, Bb, F, Fr
Nasturtium officinale[19]	LEKO-'ELE'ELE, watercress	X	NS
Oxalis coriculata[19]	'IHI'AWA, yellow wood sorrel	P	NS
Pandanus tectorius[19,11]	HALA	E, I	L, S, R
Peperomia latifolia[19]	'ALA'ALAWAINUI	E	Bd, St, Fr, F, L
Piper methysticum[19,27]	'AWA, KAVA	P	L, B, R

is comprised of about 50 species. Mamane is endemic in Hawaii and, although usually a shrub, it may reach 15 meters in height; it grows at altitudes of 450 to 3,240 meters. It is found on all islands except Niihau and Kaho'olawe[9a].

Figure 4: *Sophora chrysophylla*, popolo

• Chemistry: *S. chrysophylla* contains quinolizidine alkaloids including anagyrine, cytisine, matrine, sophoramine[37]. It also contains flavinoids and glycoproteins. The chemical structures of cytisine and matrine are known[33b].

• Pharmacology: Cytisine has anti-inflammatory properties and matrine suppresses some of the interleukins; both actions are useful in treatment of asthma[25g, 25h].

• Toxicity: There is no documented toxicity to *S. chrysophylla* although other Sophora species may rarely be associated with side effects from their alkaloids eg. *S. flavescens ait* with its matrine and *S. secundiflora* with its cystisine. The former in pure intravenous form has been associated with mild anaphylactic shock in one patient and the latter with nausea, convulsions, and asphyxia[23b].

• Therapy: Asthma[18].

• History: Mamane also was used for constructing sleds and digging sticks[2d].

Discussion

New Findings

Numerous plants in the Hawaiian *materia medica* were used for asthma. Several, such as *Sophora flavescens ait*, have been well documented scientifically and could be considered for Phase 1 clinical trials.

Limitations

This review of the Hawaiian *materia medica* as a guide for future cost-effective research into its members has limitations. Although all sources specifically referred to asthma or *hano* as the ailment treated, the authors' exact definition or even understanding of asthma were not given. However, many such as Handy et al[5] associate *hano* with cough, wheeze and difficulty in breathing. Even today a universally accepted definition for asthma has not been formulated.

Certain authors were not precise in listing their original sources of information about the specific plants. There are some inconsistencies in matching scientific names with Hawaiian names; some Hawaiian plants have not yet been assigned a scientific name. A botanical authority, Dr I A Abbott[16] and a research botanist, L A Mehrhoff[17] minimized these differences.

Assigning a definite time period as to when these *tradi-*

(Continued) ➤

TABLE 1c - HAWAIIAN MATERIA MEDICA USED FOR ASTHMA

BOTANICAL	HAWAIIAN, COMMON	SOURCE	FORMAT
Pleomele aurea[19]	HALAPAPE	E	R, B, L
Portulaca oleracea[19]	pigweed	X	NS
Psilotum triquetum[19]	MOA	I	NS, L, seed
Rumex giganteus[19]	PAWALE	E	S
Saccharum officinarum[19,34]	KO, sugarcane red, white	P	S
Sadleria spp[19,34]	'AMA'UMA'U	E	T, S, St, NS,tea
Santalum spp[19]	'ILIAHI, sandalwood	E	L, Bb, stem
Sida fallax[19]	'ILIMA	E, I	NS, B, S, R, F
Solanum americanum[19,34]	POPOLO, glossy nightshade	I	L, B, R, Fr, Bb,F
Sophora chrysophylla[18]	MAMANE	E	NS
Stenogyne scrophularioides[19]	MOHIHI	E	NS
Syzygium malaccense[19]	'OHI'A'AI, mountain apple	P	NS, B
Ulva fasciata[10]	LIPALAHALAHA	I	WEED
Vigna marina[19]	'OKOLEOMAKILI, beach pea	I	Bb, L, F, NS
Waltheria indica[19,5,34]	'UHALOA, HI'ALOA	I	Bb, B, R, L, F, tea, smoked
Wikstroemia oahuensis[19]	'AKAI LAU-NUI	E	NS
Xanthium strumarium[10]	KIKANIA	X	L

B= bark; Bb= bulb; E= endemic; F= flower; Fr= fruit; I= indigenous; L= leaf; N= naturalized; NS= non-specific reference; P=Polynesian introduced; R= root; S=shoot; Sh= shrub; T= trunk; X= not native (post-1778).

tional remedies were used is difficult. The oldest printed description of the oral tradition was published in the mid-1800s. Unpublished oral traditional herbal use may reflect more closely the Hawaiian traditional *materia medica*; the use of certain herbs has been traced back to AD 800.

Furthermore, we have no way of knowing whether a certain medicinal herb contained active ingredients, was used solely for the purpose of making the herbal preparation more palatable, or to reduce side effects. Certainly some were of questionable efficacy[5].

It has been found that the degree of pharmacological activity of *awa* varied with geography, techniques of cultivation, types of preparation, and the presence of other chemicals[24a].

Implications

Despite the excellence of the western therapeutic approach to asthma, it is not without inadequacies, especially in its inability to control the mortality epidemic of the 1980s and 1990s in Hawaii. On the other hand, the Hawaiian *materia medica* shows potential advantages such as cultural acceptance and lack of side effects, both tending to improve patient compliance. In addition, the cost of medication is often only a few cents a day.

At least 2 of the Hawaiian *materia medica* should be investigated in greater depth. *Aleurites moluccana* or kukui was mentioned in 4 independent written sources and 1 oral. *Sophora chrysophylla* is even more promising, not only because of previous scientific investigations, but the results of cell culture, animal, and clinical investigation of *Sophora flavescens ait* may be extrapolated to this local medication[38].

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